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09/787002
JG08 Rec'd PCT/PTO 12 MAR 2001

Applicant notes regarding national phase of application PCT/HR99/00022 before USPTO

1. Priority is claimed on Croatian application P980536A of Oct.05.1998.
2. International application PCT/HR99/00022 was filed in English and is the exact translation of the P980536A.
3. International application should have been communicated to USPTO by PCT-IB.
4. International search was performed by EPO and should have been communicated to USPTO by PCT-ISA.
5. International preliminary examination was performed by EPO and should have been communicated to USPTO by PCT-IPEA. IPEA report was issued in English.
- 6. Amendments were submitted in English and should have been communicated to USPTO by PCT-IPEA.
7. Certified copy of the priority document P980536A is attached to the Declaration. The international application PCT/HR99/00022 is the exact translation of the priority document.
8. Information disclosure statement by applicant cites two papers of the applicant, published after the priority date, but before international application publication. Applicant considers all other information disclosures not relevant or cumulative to the cited ones. Both papers are attached to the Statement, despite paper (1) was cited in ISA report and should have been communicated to USPTO by PCT-ISA.
9. Credit Card Payment Form is included. USD 430.00 amount is calculated claiming small entity status of the sole inventor.

Julije Ozegovic
03/05/2001

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

**Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE**

in its capacity as elected Office

Date of mailing (day/month/year) 29 June 2000 (29.06.00)	in its capacity as elected Office
International application No. PCT/HR99/00022	Applicant's or agent's file reference 0001
International filing date (day/month/year) 29 September 1999 (29.09.99)	Priority date (day/month/year) 05 October 1998 (05.10.98)
Applicant OZEGOVIĆ, Julije	

- 1. The designated Office is hereby notified of its election made:**

☒ in the demand filed with the International Preliminary Examining Authority on:

02 May 2000 (02.05.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p>Christelle Croci</p> <p>Telephone No.: (41-22) 338.83.38</p>
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REC'D 11 JAN 2001

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PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 0001	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/HR99/00022	International filing date (day/month/year) 29/09/1999	Priority date (day/month/year) 05/10/1998
International Patent Classification (IPC) or national classification and IPC H04L12/56		
Applicant OZEGOVIC, Julije		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 6 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 02/05/2000	Date of completion of this report 05. 01. 01
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Huber, O Telephone No. +49 89 2399 8967 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/HR99/00022

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*

Description, pages:

3-19	as originally filed			
1,2	as received on	12/10/2000	with letter of	04/10/2000

Claims, No.:

15	as originally filed			
1-14	as received on	12/10/2000	with letter of	04/10/2000

Drawings, sheets:

1/4-4/4	as originally filed
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2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/HR99/00022

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes:	Claims	1-14
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-14
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-14
	No:	Claims	

2. Citations and explanations
see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1) Closest Prior Art and its Problem

As defined in detail in the preamble of Claim 1, the invention relates to a packet switching data communications network with closed loop implicit feedback flow control which allows calculation of optimal window size and delay.

This preamble is in accordance with the closest prior art document D1 = Yang C. "A taxonomy for Congestion Control Algorithms in Packet Switching Networks", IEEE NETWORK, vol. 9, no. 4, 1 July 1995, pages 34-45, XP000569791, ISSN: 0890-8044, which also shows various congestion control algorithms for packet switching networks.

Classic loop control algorithms with implicit feedback are described in D1, e.g. Slow Start scheme, timeout based scheme, tri-S state and Warp control which are shortly discussed (table 3).

The problems of the systems in D1 are, that it is difficult to find optimal packet window and rate calculation based on these algorithms, because the packet transmitter has to define new optimal rates using embedded transmitter algorithms with typically linear increase and exponential decrease of rate.

2) Object of the Invention

The object of the present invention is to provide optimal packet window and rate calculation in networks with closed loop implicit feedback flow control.

3) Solution and Advantage

The solution is characterised in that the total network capacity point W_0, T_0 (number of own packets in the network, round trip time) distribution plane is known, which contains network response curves. This plane is used with

measured W,T points to determine whether the current point is below or above this curve in order to calculate optimal window and delay.

4) Conclusion and General Remarks

The solution to this problem proposed in the Packet switching data communication network (Claim 1) of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

The concept of the Window-Time-Space Flow Control, according to Claim 1, are not disclosed in or rendered obvious by the other documents cited in the International Search Report.

Claims 2-14 are dependent on Claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

In D2 = J. Ozegovic "Window time space flow control", Proceedings 7th international conference on computer communications and networks, 12-15 October 1998, pages 800-807, XP002133778, Lafayette, LA, USA, is not considered relevant state of the art, because the croatian priority document P980536A of the application, dated the 5.10.1998 is valid.

Document D3 = Xie G G et al, "Real time block transfer under a link sharing hierarchy", IEEE/ACM Transaction on networking, US, IEEE INC, New York, vol. 6, no. 1, 1 Feb 1998, pages 30-41, XP000733549, ISSN 1063-6692, is only concerned with transferring bursts of packets and a corresponding admission control algorithm.

Claims 1-14 are novel, inventive and industrially applicable.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 0001	FOR FURTHER ACTION <small>see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.</small>	
International application No. PCT/HR 99/ 00022	International filing date (day/month/year) 29/09/1999	(Earliest) Priority Date (day/month/year) 05/10/1998
Applicant OZEGOVIC, Julije		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (see Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

DEVICES WITH WINDOW - TIME - SPACE FLOW CONTROL (WTFC)

DESCRIPTION OF THE INVENTION

1. FIELD OF THE INVENTION

This invention concerns devices with data flow control, used in packet switched telecommunications networks. According the international classification (MKP) it is classified as H 04 L 12/56 - SECTION H - ELECTRICITY, TRANSMISSION OF DIGITAL INFORMATION. Data switching networks, packet switching systems.

2. TECHNICAL PROBLEM

Modern telecommunications networks use advances of information statistical multiplexing, achieved with packet switching, despite packet length is variable up to some limit (Internet) or fixed (ATM), and despite packets are forwarded individually or using virtual channels. Users segment their data to packets in terminal equipment and send them to the network, while network nodes route packets to their destinations.

In case when, in the time of observation, a network node receives less packets than the capacity of output channels used to forward those packets, the network is underutilized. In case when more packets are received, some of them will be transferred up to the full capacity of output channels, and the rest will be buffered in node's memory. The network is overloaded, and congestion has occurred. Because of packet buffering, the average packet must wait for transmission of the previous packets, and its waiting time is prolonged.

Statistical properties of incoming traffic (packet network terminals send packets at arbitrary moments) influence occasional congestion and network underutilization. To provide quality of service (QoS) it is necessary to minimize the number of packets in node's queues, but to the level that will provide satisfactory network utilization. This is optimal network working point, kept by congestion control measures, including congestion avoidance when congestion is not apparent, and congestion elimination, after for some reason congestion has occurred. The most important congestion avoidance measure is flow control.

The flow control in packet networks is achieved by packet sending rate regulation in network terminals. In case of network underutilization, terminals should increase, otherwise, in case of congestion, they should decrease packet sending rate.

3. PRESENT STATE OF THE TECHNIQUE

The flow control problem is apparent for last ten years, and a number of investigators work on it worldwide. Despite numerous scientific papers and granted patents, the very fact, that old unsatisfactory solutions from 1988. are used in the Internet nowadays, shows that right solution of the flow control problem has not been discovered yet.

The basic mechanism of congestion occurrence is packet buffering in node memory. Packets are stored to queues, waiting to be transferred through channels. Prolonged packet waiting time is a consequence of packet buffering. The time packet spends on it's route from source to destination, and similar time acknowledgment spends in backward direction, are together called Round Trip Time (RTT, or simply T), and its prolongation because of waiting we consider to be basic quality of service measure in packet switching networks.

The flow control solution is searched using two approaches. In the first approach, network nodes do not provide data about network state, but rather store excessive packets in memories, or discard remaining packets when memories are full. Terminals of such networks measure round trip time T, window W (the number of their own packets on the network) and packet losses, and try to adjust their packet sending rate. In the second approach, network nodes provide data about network state implicitly (e.g. enforcing waiting time or packet loss rate) or explicitly (e.g. sending forward or backward congestion indications, or even signaling the optimal sending rate for the data flow). When explicit notification is used, the data processing load in nodes can be very large, prohibiting the use of some recently proposed solutions. In all cases, except when optimal rate is explicitly signaled, packet transmitter defines new optimal rate using embedded transmitter algorithms (linear increase and exponential decrease of rate are most frequently used). Further systematization and references can be found in: C-Q Yang, A.V. Reddy, "A Taxonomy for congestion Control Algorithms in packet Switching Networks" IEEE Network, Vol. 9, No. 5, Jul 1995.

Regarding present state of the art, the invention solves the problem of optimal packet window and rate calculation in networks with closed loop implicit feedback flow control.

4. THE INVENTION ESSENCE EXPOSITION

The invention in this patent request deals with the solution of the congestion in packet networks by proposing devices using improved flow control method. The novelty of the invention, related to the present state of the technique, is flow control in window - time space, used to achieve optimal packet sending rate and uniform times between packets. This provides high network utilization and high quality of service, while keeping network node processing load at minimal level.

PATENT CLAIMS

1. Packet switching data communications networks or packet networks with closed loop implicit feedback flow control comprising Window-Time-Space Flow Control, WTFC, where
 - determined single server queuing system model with finite number of packets and known total network capacity point W_0, T_0 , define window - time plane/space.
 - said plane contains network response curves for various fractions of total capacity, determined with break points lying on the hyperbola through W_0, T_0 .
 - said plane together with current W, T point measurement is used to determine whether said W, T point is positioned above or below the hyperbola, and to calculate optimal capacity fraction and break point coordinates of the current response curve.
 - said break point coordinates are used to calculate optimal window and delay, and their ratio to obtain optimal packet sending period;
 constructed using
 - terminals that do use said window - time plane and W, T point measurement to obtain optimal packet sending period and window, and are constructed using receiver (113) and packet transmitter (101) of packets or other data units, and
 - nodes (201) that do or do not signal the total network capacity W_0, T_0 in form of elementary network channel parameters.
2. Packet transmitter (101) of Claim 1 that form packet in segmentation process (102) when user data exist and include in it's header acknowledgment data as ordered from the receiver, or form separate acknowledgment packet as ordered from the receiver, store packet in packet buffer (104) and emit packet through packet sending process (105) comprising initialization process (103).
3. Packet transmitter (101) of Claim 1 further comprising the packet sending initiation when
 - condition of packet sending period $t_0''(\alpha)$ expiration in process of transmission rate clock signal with one credit buffer (108) and
 - condition of optimal window $W_0(\alpha)$ not being filled in process of optimal window check (111) that verifies whether current window is less than $W_0(\alpha)$
 are both satisfied.

4. Packet transmitter (101) of Claim 1 further **comprising**:

- check of measured point W, T position in area check process (112) by calculating condition

$$(W - 1)/(W_0 - 1) \geq T_0 / ((T - T_0)W_0 + T_0)$$

- calculation of $W_0(\alpha)$ in $W_0(\alpha)$ calculation process (110) using

$$W_0(\alpha) = T_p \cdot W/T + 1 \text{ and } W_0(\alpha) = T_p / (T - T_p) + 1$$

- calculation of $t_0'''(\alpha)$ in $t_0'''(\alpha)$ calculation process (107) using

$$t_0'(\alpha) = T/W_0(\alpha), \quad t_0''(\alpha) = t_0'(\alpha)(1 + \gamma T_0) \text{ and } t_0'''(\alpha)_k = \begin{cases} \beta t_0'''(\alpha)_{k-1} + (1 - \beta)t_0''(\alpha)_k \\ t_0''(\alpha) \end{cases}$$

5. Packet transmitter (101) of Claim 1 further **comprising**:

- usage of parameters provided by receiver (113) after acknowledgment reception.

- W, T point measurement in W, T inside the point measurement process (106) using

$$T = t(A_k) - t(P_k), \quad W = P_k - A_j \text{ and } W_k = (k - j)(t(A_k) - t(P_k)) / (t(A_k) - t(A_j))$$

- calculation and correction of parameters W_0, T_0 and T_p inside the total capacity estimation and correction process (109)

6. Packet receiver (113) of Claim 1. that after packet reception with packet reception process (115) extract data with extraction process (114) and deliver them to users. **comprising**

- extraction of cumulative propagation time, cumulative reciprocal capacity, minimal reciprocal capacity, last acknowledgment and sending time parameters from the packet header inside the extraction process (114), and
- delivery of extracted parameters to the packet transmitter (101).

7. Initialization process (103) of Claim 2 **comprising** initialization of packet header variables by:

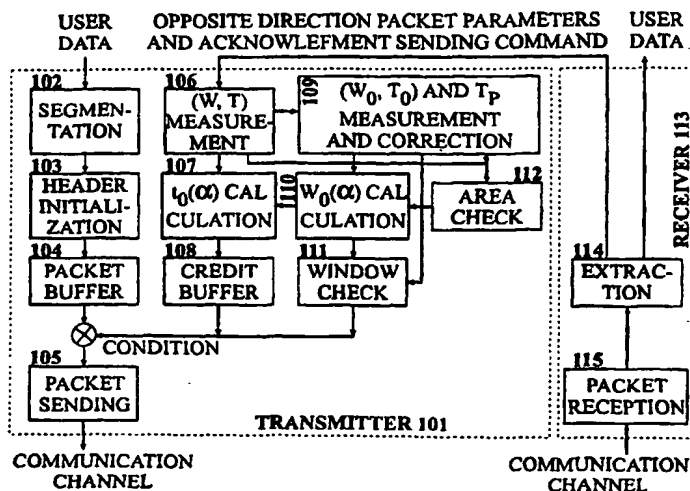
- setting the forward last acknowledgment variable a_{fr} to the value of last acknowledgment number received,
- setting backward last acknowledgment variable a_{br} to the value of the same forward variable received in packet from the opposite direction, whose acknowledgment number is carried by new packet,
- setting forward sending time variable $T(p_k)_f$ to actual local time
- setting backward sending time variable $T(p_k)_b$ to the value of the same forward variable received in packet from the opposite direction, whose acknowledgment number is carried by new packet

8. Initialization process (103) of Claim 2 further comprising initialization of packet header variables when total network capacity signaling method is used, by:
 - setting forward propagation time cumulative variable T_{pof} to zero
 - setting forward reciprocal capacity value cumulative variable S_{cif} to zero.
 - setting forward reciprocal minimal channel capacity variable C_{iminf} to the maximal value
 - copying values from variables T_{pof} , S_{cif} , i C_{iminf} received in the opposite direction packet to the same backward variables.
9. $t_0''(\alpha)$ calculation process (107) with one credit buffer (108) of Claim 3 comprising connection startup algorithm for smooth packet sending, and after expiration of period initialized:
 - before first acknowledgment reception, and if there is no credit stored, increments credit buffer by 1 and reinitiates the same time period.
 - before first acknowledgment reception, and if there is credit stored, initiates double time period and initiates packet emitting.
 - after first acknowledgment reception sets credit buffer to 1 and initiates packet emitting
10. Total capacity estimation and correction process (109) of Claim 5 comprising, when network capacity signaling method is used.
 - calculation of T_p by $T_p = \sum_i T_{pi} + \sum_i T_{si} - T_{sb} = T_{p0} + \overline{M} \left(\sum_i 1/C_i - 1/C_b \right)$,
 - calculation of T_0 by $T_0 = T_s + T_p$,
 - calculation of W_0 by $W_0 = T_0/T_s$,
 applying extracted parameters from first or every packet received from the opposite direction
11. Total capacity estimation and correction process (109) of Claim 5 further comprising, when network capacity estimation and packet pair methods are used.
 - calculation of T_0 using $T_0=T$ after the first acknowledgment is received.
 - calculation of W_0 using $W_0=T_0/(T-T_0)$ after the second acknowledgment is received
 applying extracted parameters from every packet received from the opposite direction

12. Total capacity estimation and correction process (109) of Claim 5 further **comprising**, when network capacity estimation and packet pair methods are used, if measured $T < T_0$
- correction of T_0 using $T_0 = \min(T)$,
 - correction of W_0 using $W'_0 = \max\left(\left(T'_0/T_0\right)W_0, W\right)$ if $T < T_p$, otherwise using $W'_0 = T'_0 / \left(T'_0 - T_p\right)$ and $W'_0 = T'_0 / T_s$
 - correction of T_p using $T_p = T_0 (W_0 - 1) / W_0$.
- applying measured parameters from every packet received from the opposite direction.
13. Nodes (201) of Claim 1, that forward packets with forwarding process (202), **comprising**, when network capacity signaling method is used, capacity signaling process (203).
14. Capacity signaling process (203) of Claim 13 **comprising** the modification of first or every packet by
- updating forward propagation time cumulative variable T_{p0} using $T_{p0} = \sum_i T_{pi}$.
 - updating forward reciprocal capacity value cumulative variable S_{cif} using $T_{s0} = \overline{M} \sum_i 1/C_i$,
 - updating forward reciprocal minimal channel capacity variable C_{imin} using $C_h = \min_i(C_i)$

(51) International Patent Classification ⁷ : H04L 12/56, H04Q 11/04		A3	(11) International Publication Number: WO 00/21244
			(43) International Publication Date: 13 April 2000 (13.04.00)
(21) International Application Number: PCT/HR99/00022		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 29 September 1999 (29.09.99)			
(30) Priority Data: P980536A 5 October 1998 (05.10.98) HR			
(71)(72) Applicant and Inventor: OZEGOVIC, Julije [HR/HR]; Istarska 2, 21000 Split (HR).			
(74) Agent: PAIC, Sutjeska; Goricka 4, 21000 Split (HR).		<p>Published <i>With international search report.</i></p> <p>(88) Date of publication of the international search report: 6 July 2000 (06.07.00)</p>	

(54) Title: DEVICES WITH WINDOW - TIME - SPACE FLOW CONTROL (WTFC)



(57) Abstract

In packet switching telecommunications networks, flow control is used to obtain optimal network working point, regulating the transmitter packet sending rate. The state of overload (congestion) or underutilization of the network can be detected explicitly using signaling from network nodes, or implicitly using number of packet (window W) and round trip time (T) measurements. The Window–Time–Space Flow Control (WTFC) is a method of determining the belonging part of network capacity, optimal packet sending rate and optimal window, based on the measured (W, T) point in the window–time space and knowledge about total network capacity (W_0, T_0). In this way, devices with WTFC, nodes and terminals, keep optimal network working point near the on average empty queues mode of operation. With networks utilizing WTFC, nodes can signal network parameters at connection establishment only. After that, all WTFC processing is done by terminal packet transmitter. WTFC transmitter determines both optimal window and optimal sending rate, thus improving regulation stability, limiting the number of packets in the network, and decreasing the variance of transmission rate.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

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DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

INTERNATIONAL SEARCH REPORT

National Application No.

PCT/HR 99/00022

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L12/56 H04Q11/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	J. OZEGOVIC: "Window-time-space flow control (WTFC)" PROCEEDINGS 7TH INTERNATIONAL CONFERENCE ON COMPUTER COMMUNICATIONS AND NETWORKS, 12 - 15 October 1998, pages 800-807, XP002133778 Lafayette, LA, USA /* whole article */	1-15
A	YANG C -Q ET AL: "A TAXONOMY FOR CONGESTION CONTROL ALGORITHMS IN PACKET SWITCHING NETWORKS" IEEE NETWORK: THE MAGAZINE OF COMPUTER COMMUNICATIONS, US, IEEE INC. NEW YORK, vol. 9, no. 4, 1 July 1995 (1995-07-01), pages 34-45, XP000569791 ISSN: 0890-8044 /* whole article */	1-15
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☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

22 March 2000

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Original Application No

PCT/HR 99/00022

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>XIE G G ET AL: "REAL-TIME BLOCK TRANSFER UNDER A LINK-SHARING HIERARCHY" IEEE / ACM TRANSACTIONS ON NETWORKING,US,IEEE INC. NEW YORK, vol. 6, no. 1, 1 February 1998 (1998-02-01), pages 30-41, XP000733549 ISSN: 1063-6692 page 30, left-hand column, line 27 - line 32</p>	3